The Power of Online Analytical Processing in Healthcare

Key Words: OLAP, Data Cube, Multidimensional Analysis, Data Analysis, Filtering

Introduction

Data stored in an organization's databases and other data sources are retrieved and used to perform various organizational functions and to make important decisions. When data is inaccurate, missing or not utilized effectively, the processes performed and decisions made by the organization will be impaired. "Garbage in, garbage out" is the reality to reckon with. Besides healthcare organizations needing good data, they also need the right set of tools to harness and analyze the prolific data in the business environment.

Successful data analysis is, therefore, the golden key to successful results. The sheer magnitude of information in today's healthcare world is overwhelming, whereas the current ability to properly store, analyze and understand this data is astonishingly weak. It is imperative that organizations implement knowledge management initiatives to make strides in leveraging data for better decision-making. Data warehousing, data mining, customer relationship management and OLAP are all tools and applications that bring knowledge management to the forefront in an organization. In this article, we will discuss Online Analytical Processing or (OLAP) and its role in properly capturing and then analyzing medical information. By making use of intelligent and intuitive operations, OLAP applications provide an exceptional tool for conducting sophisticated analyses and examinations.

What is OLAP?

OLAP is a computing technique for summarizing, consolidating, viewing, applying formulae to and synthesizing data according to multiple dimensions. OLAP software enables users, such as analysts, managers and executives, to gain insight into performance of an enterprise through rapid access to a wide variety of data views that are organized to reflect the multidimensional nature of the enterprise performance data.

OLAP provides a fast way of viewing and analyzing data from any perspective without having to specify the perspective and the exact level of detail required in advance.

In other words, OLAP is a technology that offers fast access to multidimensional information for exploitation in a wider business intelligence context. Online Analytical Processing is a function of software technology that enables analysts, administrators, and executives to gain key insight into crucial elements of data. This examination of information via rapid, consistent, and interactive access provides for a wide variety of possible views of information, transformed from raw data to reflect the various dimensions of reality. The information gained by an individual conducting this analysis can be said to represent the core data of an enterprise, but in a manner that is understood by the user. Due to its versatile ability for presentation of data, OLAP provides its analysts with a significantly profound level of comprehension for its multitude of medical information.

In the area of leveraging an organization's operational data to create strategic acumen, OLAP also supports data warehousing as a decision support tool. Using OLAP, enterprises can drive decision support, do trend analysis, compare business units, and monitor strategic business decisions. OLAP data is presented in a way that reflects multiple business dimensions, for example, patients admitted per quarter by disease category, costs per service line by region, medical supplies shipped on time per department per hospital, and so forth. This type of information allows managers to effectively conduct comparison and trend analysis.

OLAP And Multidimensional Analysis

The multidimensional nature of a problem is simultaneously looking at the data from multiple points of view. The key driver for OLAP technology is this aspect of multidimensional views. For example, a business analyst might want to get monthly (time dimension) reimbursement data for a set of services (service dimension) across all patient segments (patient dimension) and across all age groups (age dimension) to analyze payer patterns. This is a multidimensional expression of a real business problem. OLAP has the inherent ability to present data in many views

and at different granularities by virtue of OLAP operations, such as slicing, dicing, drill down, pivoting and filtering.

To elaborate, OLAP functionality is characterized by the dynamic, multi-dimensional analysis of consolidated enterprise data. This process makes it possible to analyze potentially large amounts of data with very fast response times, allowing users to drill down to the most granular levels of detail for the most optimal of knowledge gain. Further functionality is offered as OLAP helps the user synthesize enterprise information through comparative, personalized viewing, as well as via an analysis of historical and projected data for various 'what-if' data model scenarios. With such a wide variety of avenues by which a user can analyze data,

OLAP is a tool of paramount importance for those who wish to conduct a serious investigation of medical trends and practices.

OLAP is optimized for multidimensional query and report. An increasingly popular data model for OLAP applications is the multidimensional database (MDDB), which is also known as the data cube. OLAP cubes store pre-computed results of data at different levels and, hence, multidimensional query results are returned faster. Before we can examine the various components of OLAP, a solid understanding of its foundation must be made. Every application, or process, has an underlying core, a core upon which the entire function takes place. For OLAP, this underlying core is an element known as a data cube, an entity that holds the boundless amount of information upon which analyses can be made. It is this cube that is developed, manipulated, and transformed in different ways to produce the results that OLAP delivers.

What Is A Data Cube?

A data cube is a collection of one or more tables of data, assembled in a fashion that allows for dynamic analysis to be conducted on the joins, intersections, and overall integration of these predefined tables. Since these tables are thoroughly populated with the information that is used for analysis, it is obvious to see how a data cube serves as a superlative structure. Creating an intelligent construction based on how information in these tables intersects and interrelates is the core property of a data cube, allowing for a powerful entity to be probed for analysis.

Trying to understand a cube visually, it can be said that a cube is an accumulation of several two-dimensional tables or squares, which can be attached together, strategically, to create a three-dimensional cube. A physical cube, after all, is simply a set of squares that have been put together and, in a similar manner, a data cube is simply a set of tables that have been wisely compiled into one, collective structure.

Looking functionally at this structure, we can see that a data cube is merely an entity that extracts information from numerous databanks and arranges it in a manner that yields an optimal level of data interrogation and analysis.

Using this cube structure, OLAP is able to properly present to its users a wealth of insightful views and perspectives into various databanks of medical information. A cube is laid out in a manner that represents the row and column conventions of a common table, but then enhances this design with the addition of, what are called, pages. A page represents a filter of the current data being viewed, in that when a page is changed, it alters the view, purpose, or intent, of that analysis to a completely different perspective. While one page may filter the data for the highest expense by a particular department, another page may breakdown the actual patients and their particular treatment, which contributed to that same highest cost. By passing an unlimited set of different magnifying glasses over the same set of data, different results and meanings emerge to provide a 360-degree analysis of how this data can provide the power of knowledge.

OLAP And Data Analysis

OLAP provides a variety of operations that users can employ to gain the most out of their data analysis endeavors. Some common actions that can be conducted with OLAP are as follows:

- calculating and modeling across dimensions, through hierarchies, and across members
- exploring trend analyses over sequentially sectioned time periods
- slicing through various subsets for on-screen viewing
- drill-down operations to deeper levels of consolidation
- reach-through abilities to underlying detail data
- rotation to new dimensional comparisons for investigation

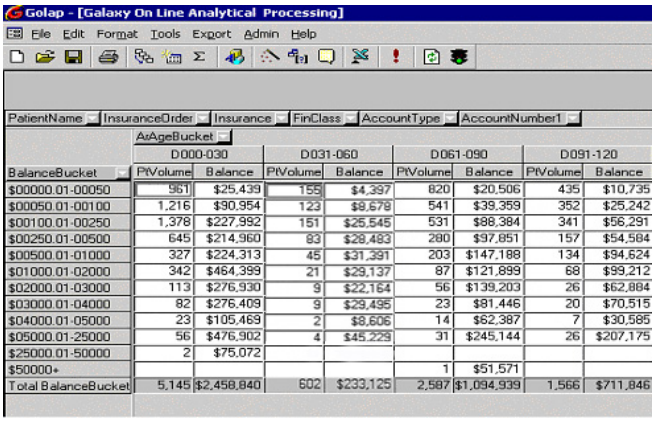
Without proper data analysis, it is very difficult to absorb the full potential of data that is collected by healthcare organizations. Due to the incredible amount of data to be dissected and then understood, it is very important that OLAP be used to successfully extract the greatest amount of value from seemingly disparate data.

OLAP, if properly employed, can become the added factor that can transform the emptiness of 'data' into the riches of information and knowledge.

OLAP – Numbers In Action

In order to provide the readers with an actual illustration of how OLAP can be used, let's take a look at a very simple, yet effective example of data analysis using OLAP in the area of final billed analysis. In this illustration, we will conduct an analysis using a FB Analysis cube created by TSG for a healthcare network, which represents the status of Final Billed accounts for this network. Opening up the cube, we see **Screen One**.

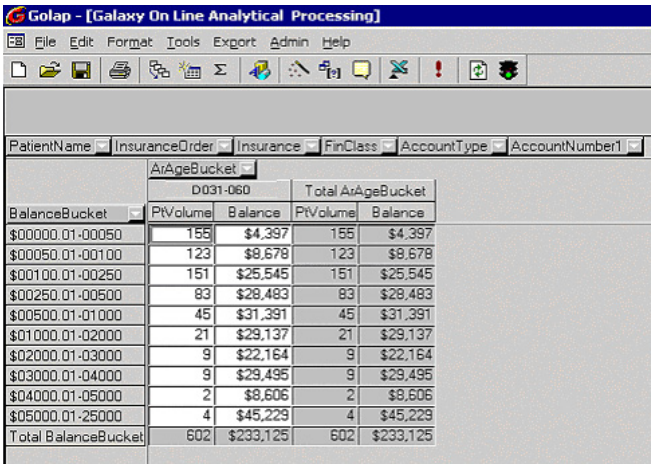
Screen One:



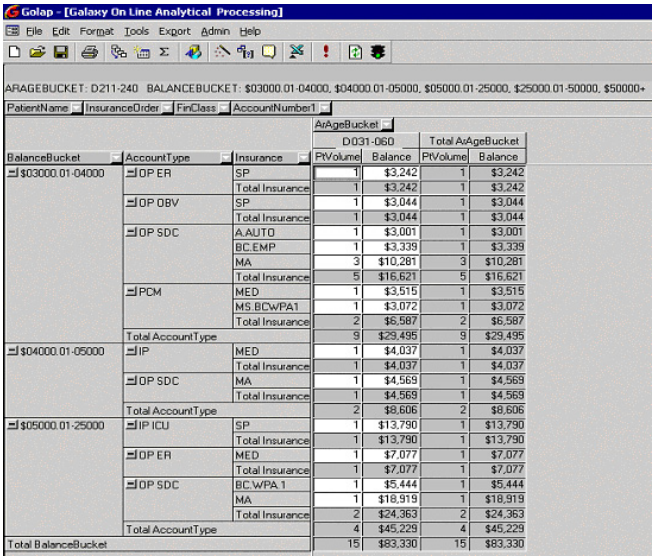
To maximize your cash flow, our goal is to ascertain how to collect the greatest amount of payment in the shortest amount of time possible. Looking at the first two columns of data in the screenshot above, we can see that it represents the number of patients and how much they owe for the last 30 days. We can immediately see that there are 961 people who owe the hospital $25,439, 1216 people who owe $90,954, and a group of 56 people who owe $476,902 etc. As reason will delineate, it is more efficient and advantageous to work with 56 accounts and gain $476,902, than it is to work with 961 accounts and collect $25,439. Already, the analysis has pointed us in the right direction for maximum monetary gain.

To expand even further, perhaps for this healthcare organization, the policy is to aggressively pursue accounts that are past due in between 30-60 days. Using OLAP's drag and drop filtering, we can focus on only those accounts that owe money for 31 – 60 days (**see Screen Two**). We can see from Screen Two's column that our best and most rational approach is to pursue the 4 accounts that will supply us with $45,229. In order to get underway on learning more about these 4 accounts and the who, what, where, when, and why's of the circumstances, let us utilize the various page filters to probe further (**see Screen Three**).

Screen Two:



Screen Three:



By simply dragging down the Account Type and Insurance page filters, we learn a great deal about the breakdown of various accounts. The bottom segment of **Screenshot Three** ($5000- $25000) illustrates the breakdown of the 4 accounts we decided to monitor. From filtering, we can see the various services these patients received at the hospital (Account Type), as well as what insurances these patients belong to. If desired, the Patient Name and Account Number filters can also be dragged down, revealing the precise names and medical record numbers of the patients involved in the analysis. This can be an incredibly beneficial tool for analysts who wish to know anything and everything about the accounts in question. This concludes a short and simple example of the amount of knowledge that can be obtained via OLAP's analysis abilities, which can be done so in a variety of manners and techniques.

Conclusion

IDC estimates IT expenditure will grow from $111 billion in 1999 to $1.3 trillion in 2003. Subsequently, data will grow at an exponential amount in all organizations, including healthcare. This growth rate and subsequent complexity underline the need for appropriate, fast and more efficient data analysis solutions. Solving modern business problems, such as clinical analysis, market analysis and financial forecasting, requires query-centric database schemas that are multidimensional. Hence, the incredible amount of time, money, and knowledge that is gained from successful data analysis using OLAP is definitely something that cannot be ignored. Healthcare organizations that place importance on data analysis and understanding are, surely, standing heads and shoulders above the crowd, reaping maximum benefits that lead to efficiencies in their overall operations.

OLAP is the premier tool these organizations can utilize to emerge as leaders in their industry, thanks to optimal information gain and the power of knowledge.

By implementing OLAP for their data analyzing endeavors, medical institutions can be sure that they will always be up to speed with the trends, practices, and events of the ocean of data in which they perform.

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